RMRC

Recycled Materials Resource Center

THE UNIVERSITY of WISCONSIN MADISON

Project Principle Investigators
Ali Soleimanbeigi, Ph.D., P.E.
: (608) 444-3460
: soleimanbeig@wisc.edu
William J. Likos, Ph.D.
: (608) 890-2662
: likos@wisc.edu
Department of Civil Engineering
University of Wisconsin-Madison
Madison, WI 53706
Burak F. Tanyu, Ph.D.
George Mason University
: (703) 993-5621
: btanyu@gmu.edu
Ahmet H. Aydilek, Ph.D.
University of Maryland – College Park
: (301) 405-2692
: aydilek@umd.edu
Paulo Florio, M.Sc. Candidate

RMRC
University of Wisconsin-Madison
Engineering Centers Building
1550 Engineering Drive
Madison, WI 53706
: (608) 890-4966
: angela.pakes@wisc.edu

Research Project 84

Recycled Materials as Backfill for Mechanically Stabilized Earth Walls

Project Objectives

- Facilitate use of Recycled Asphalt Pavement (RAP) and Recycled Concrete Aggregate (RCA) in reinforced backfill for Mechanically Stabilized Earth (MSE) retaining wall construction.
- Conduct experimental tests to measure the suitability of RAP and RCA as backfill

Project Summary

Traditionally, reinforced granular backfill is sourced from crushed rock quarries and gravel pits. This is both expensive and undesirable for the environment. RAP and RCA provide sustainable alternatives and are produced in vast quantities in the US every year. The following tests were conducted using both products to measure their effectiveness in MSE retaining wall construction:

- Index Property Tests
  - Grain Size Distribution and Gradation
  - Specific Gravity and Absorption
  - Compaction Characteristics
- Large-Scale Consolidated Drained (CD) Triaxial Tests
- Large Scale Interface Direct Shear Tests – to evaluate the the interaction properties of RAP and RCA with woven and non-woven geotextiles and uniaxial and bi axial geogrids.
- Pull-out Tests – to evaluate pull-out resistance of woven geotextile and uniaxial geogrids embedded in compacted RAP and RCA.
- Temperature-Controlled Creep Tests – to evaluate the effects of compaction temperature on interaction properties of compacted RAP and geosynthetics.
- Long-Term Filtration and Associated Pore Size Evaluation Tests
  - Analyses of Clogging Behavior and the Effect of Hydraulic Gradient
  - Analyses of Retention Behavior

End Results

Compacted RAP and RCA have reasonable pull-out resistance for both woven geotextiles and uniaxial geogrids compared to compacted natural granular materials. No slippage was seen, and failure was caused by geotextile or geogrid. However, based on results use of non-woven geotextile for MSE wall reinforcement is not recommended. RAP has creep behavior similar to soils with the axial strain rate log-linearly decreasing with time. Structural fill construction using RAP should be done during summer to reduce the creep strain and creep rupture potential and improve performance. The interface friction angle (δ) of RCA-Woven Geotextile was 26° and that of RCA-Nonwoven Geotextile was 19°. Compacted RAP used as backfill is susceptible to creep rupture and the maximum applied deviator stress on the compacted RAP should be reduced to 70% of the compressive strength to alleviate the problems related to creep. With increasing temperature, creep strain and strain rate for the compacted RAP increased and the time to rupture decreased.

Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials